

PRELIMINARY DATA SUMMARY

December 1990

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

PRELIMINARY DATA SUMMARY

CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

CONTENTS

	<u>Page</u>
TABLE OF CONTENTS.....	1
PART I: INTRODUCTION.....	2
PART II: METEOROLOGICAL DATA.....	6
PART III: WAVE DATA.....	9
PART IV: CURRENT DATA.....	13
PART V: SUPPLEMENTAL OBSERVATIONS.....	21
PART VI: WATER LEVELS.....	23
PART VII: NEARSHORE PROFILES AND BATHYMETRY.....	26
PART VIII: SPECIAL EVENTS.....	29

LIST OF FIGURES

<u>No.</u>		<u>Page</u>
1	FRF location map.....	3
2	Instrument locations at FRF.....	5
3	Time history of wave heights and periods.....	12
4	Water level time history	24
5	CRAB profiles.....	26
6	CRAB profile envelope.....	27
7	FRF bathymetry (31 Oct 90).....	28

LIST OF TABLES

<u>No.</u>		<u>Page</u>
1	Instrument Status/Data Availability.....	4
2	Meteorological Data.....	7
3	Wave Data.....	10
4	Current Data.....	14
5	Supplemental Observations.....	22
6	Water Levels.....	25

PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Michael W. Leffler at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

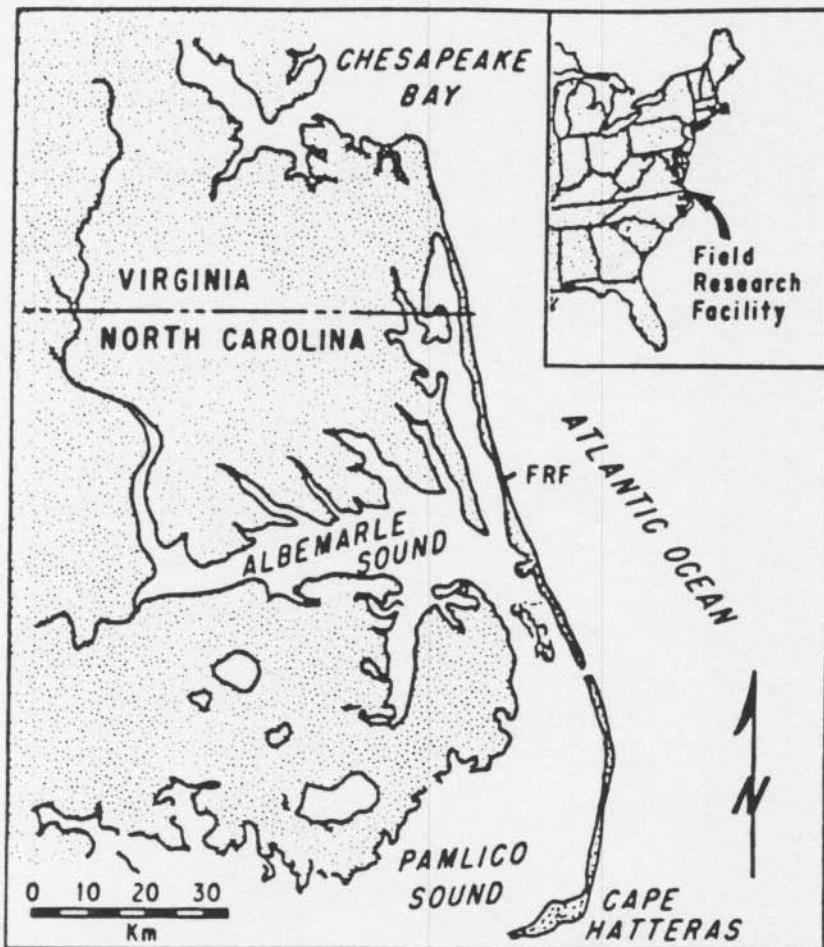


Figure 1. FRF location map

Table 1: Instrument Status/Data Availability

DEC 1990

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																																			
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1					
616	Barometric Pressure		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
604	Precipitation		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
624	Air Temperature		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
932	Anemometer at seaward end of pier Elevation 19 m (NGVD)		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	
519	Current meter 320 m north of FRF pier (0.9 km offshore)	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	Supplemental Observations (daily oceanographic and meteorological observations)		Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	

Gage Status	Daily Observation	Analog Record	Data Collected
Operational = *	Complete = *	Complete = *	All = *
Partial = /	Partial = /	Partial = /	Partial = /
Non-Operational = -	None = -	None = -	None = -

True North

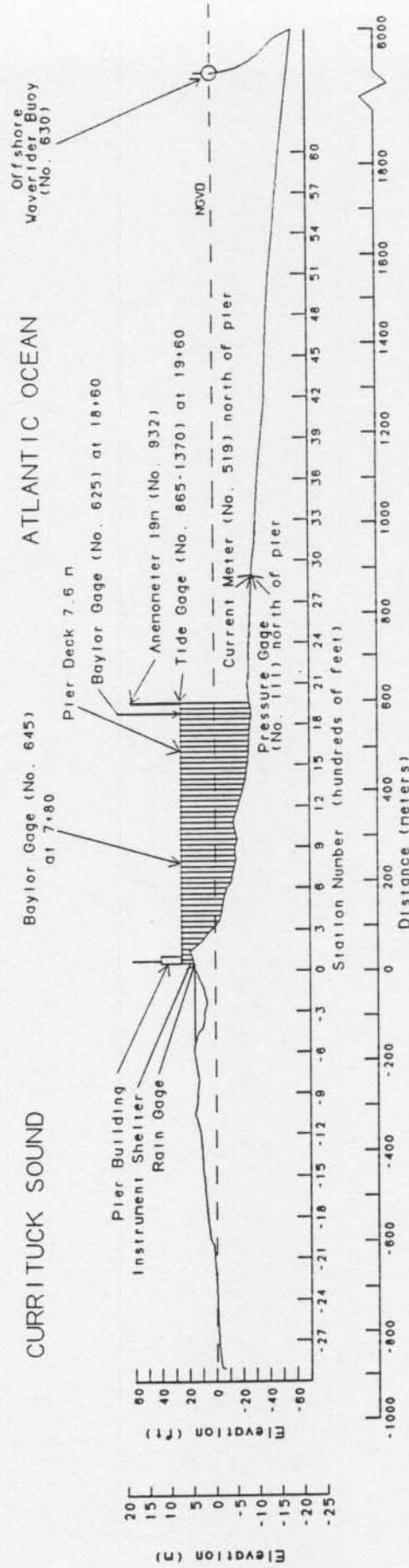
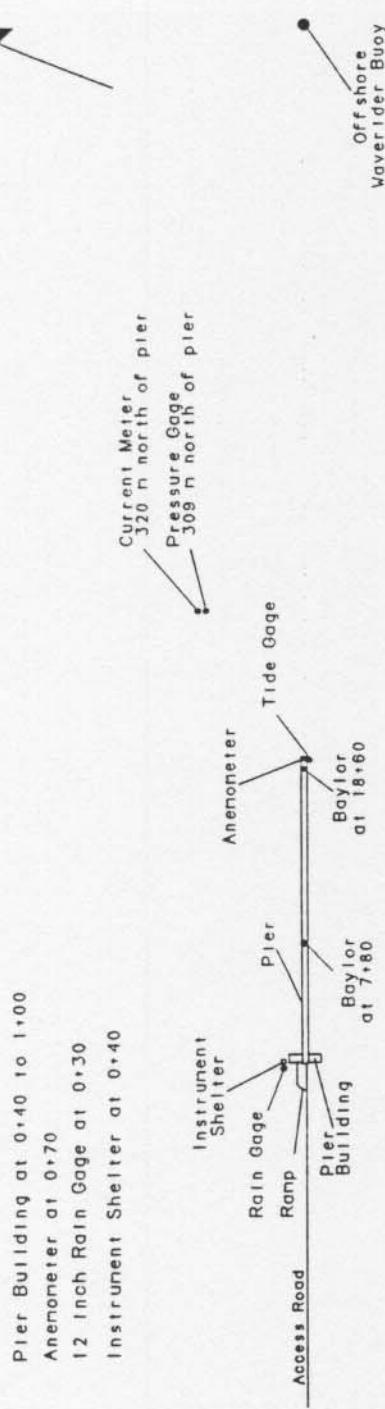


Figure 2. Instrument locations at FRF (all elevations from NGVD, all distances from FRF baseline).

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a Weather Measure Skyyane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $mm \times .03937 = in.$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $mb \times 0.02953 = in. Hg$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

Table 2: Meteorological Data

Dec 1990

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	2	207	3.7	1030.1	0
	700	3	218	5.2	1031.1	0
	1300	5	233	11.8	1028.7	0
	1900	5	201	10.4	1027.7	0
2	100	4	204	9.8	1026.7	0
	700	4	207	10.1	1026.0	0
	1300	1	248	17.5	1025.0	0
	1900	4	91	13.0	1025.7	0
3	100	7	74	12.9	1024.7	0
	700	9	96	13.9	1023.3	0
	1300	5	152	16.1	1020.3	0
	1900	12	162	18.1	1017.2	0
4	100	12	178	17.6	1012.1	0
	700	10	200	17.6	1009.1	3
	1300	9	244	16.5	1007.0	0
	1900	10	285	8.7	1013.8	0
5	100	10	283	2.9	1016.2	0
	700	10	287	1.6	1018.2	0
	1300	7	279	5.1	1019.2	0
	1900	5	275	5.4	1019.9	0
6	100	5	258	5.1	1019.2	0
	700	3	205	4.8	1018.6	0
	1300	5	219	12.1	1015.9	0
	1900	5	203	9.4	1016.2	0
7	100	4	234	8.2	1015.9	0
	700	4	258	7.0	1016.2	0
	1300	2	323	11.8	1015.9	0
	1900	3	19	10.2	1016.2	0
8	100	10	33	9.9	1012.8	10
	700	12	359	10.1	1011.8	8
	1300	15	348	9.7	1010.4	6
	1900	11	333	7.7	1012.5	0
9	100	9	325	6.1	1013.8	0
	700	14	342	6.0	1018.2	0
	1300	9	329	8.1	1018.9	0
	1900	3	262	5.5	1019.6	0
10	100	5	229	6.3	1017.5	0
	700	4	237	6.9	1016.2	0
	1300	7	244	12.3	1012.1	0
	1900	4	266	9.2	1013.5	0
11	100	13	359	10.6	1016.2	0
	700	9	7	8.2	1020.6	0
	1300	5	24	9.3	1021.3	0
	1900	1	185	5.0	1020.9	0
12	100	2	177	4.9	1020.6	0
	700	3	168	5.4	1020.9	0
	1300	4	227	13.8	1018.9	0
	1900	7	191	10.7	1017.9	0
13	100	5	221	11.0	1015.5	0
	700	5	235	9.6	1013.8	0
	1300	6	237	15.1	1011.4	0
	1900	5	209	12.7	1012.5	0
14	100	14	358	11.8	1016.9	0
	700	14	8	7.5	1024.7	0
	1300	10	26	7.9	1026.7	0
	1900	9	39	8.2	1028.0	0
15	100	8	57	10.3	1025.3	0
	700	4	137	11.9	1022.3	0
	1300	4	200	13.6	1017.5	0
	1900	2	239	10.3	1016.5	0
16	100	9	218	12.9	1012.8	0
	700	8	251	11.9	1013.8	0
	1300	3	292	14.3	1015.5	0
	1900	6	16	9.8	1018.6	0

* electronic problems

(Continued)

(Sheet 1 of 2)

Table 2: Meteorological Data

Dec 1990

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
17	100	7	5	8.7	1019.6	0
	700	6	358	7.6	1020.9	0
	1300	3	3	9.1	1019.2	0
	1900	2	140	8.1	1017.9	0
18	100	5	170	9.4	1014.2	0
	700	6	191	11.4	1010.4	0
	1300	8	194	20.3	1005.7	0
	1900	12	197	18.1	1003.7	0
19	100	9	207	17.5	1005.4	0
	700	5	322	13.9	1009.4	0
	1300	8	358	12.3	1014.8	0
	1900	8	19	11.1	1021.9	0
20	100	10	27	9.9	1024.7	0
	700	11	46	10.6	1028.4	0
	1300	11	44	12.3	1027.7	0
	1900	9	54	12.4	1028.0	0
21	100	3	134	13.1	1026.3	0
	700	5	139	13.1	1024.0	0
	1300	7	149	15.1	1021.9	14
	1900	4	159	13.6	1021.6	0
22	100	4	163	16.0	1020.9	0
	700	6	191	17.3	1021.6	2
	1300	5	194	18.3	1019.2	0
	1900	5	159	15.2	1018.9	0
23	100	8	175	18.8	1016.9	0
	700	7	184	17.8	1015.5	0
	1300	7	200	21.1	1012.8	0
	1900	7	184	18.3	1011.8	0
24	100	11	196	18.7	1007.4	0
	700	12	211	19.0	1004.3	0
	1300	9	1	12.8	1009.4	0
	1900	13	352	6.9	1017.5	0
25	100	10	349	4.2	1022.3	0
	700	9	14	2.8	1025.3	0
	1300	7	16	3.3	1025.7	0
	1900	4	17	4.0	1026.3	0
26	100	5	20	5.9	1026.0	0
	700	8	338	4.7	1028.0	0
	1300	8	1	6.5	1029.1	0
	1900	9	13	6.2	1032.1	0
27	100	10	25	6.6	1032.4	0
	700	11	30	7.6	1034.1	0
	1300	12	21	8.4	1033.1	0
	1900	8	52	10.8	1029.1	0
28	100	1	187	10.5	1024.3	0
	700	5	260	6.1	1025.7	0
	1300	3	301	7.1	1026.3	0
	1900	6	7	6.9	1028.4	0
29	100	3	318	7.4	1027.7	0
	700	3	3	8.4	1027.0	0
	1300	3	336	9.9	1026.0	0
	1900	2	163	10.3	1024.3	0
30	100	5	197	13.4	1022.6	0
	700	4	210	15.0	1021.6	0
	1300	7	224	19.0	1017.5	0
	1900	10	202	17.8	1014.5	0
31	100	10	202	17.3	1013.5	0
	700	5	221	16.2	1015.2	0
	1300	12	5	8.5	1022.3	3
	1900	10	11	7.6	1027.4	0
		Resultant		Mean	Mean	Total
		1	309	10.7	1019.6	46

* electronic problems

(Sheet 2 of 2)

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hr (more frequently during storms) beginning at 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for four contiguous 34-min records.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Dec 1990

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo.m T.sec	Baylor at 18+60	Hmo.m T.sec	Pressure Gage	Hmo.m T.sec	Offshrd Wvrdr	Hmo.m T.sec
1	0100	0.85	6.74	1.02	7.76	0.98	7.31	1.04	7.53
	0700	0.52	7.31	0.66	8.00	0.69	8.83	0.77	7.53
	1300	0.25	15.06	0.55	7.53	0.57	7.53	0.63	8.26
	1900	0.29	14.22	0.49	8.83	0.53	9.14	0.50	8.26
2	0100	0.20	12.19	0.50	10.24	0.53	10.24	0.50	9.14
	0700	0.23	9.48	0.42	10.67	0.44	13.47	0.47	10.24
	1300	0.11	10.67	0.42	9.85	0.39	9.48	0.46	9.85
	1900	0.32	11.64	0.42	12.80	0.46	9.48	0.46	9.48
3	0100	0.64	3.28	0.71	9.48	0.60	3.33	0.72	9.85
	0700	0.83	4.27	1.06	4.66	1.07	4.27	1.15	4.66
	1300	0.94	5.12	1.20	5.69	1.19	5.95	1.34	5.82
	1900	1.04	6.56	1.23	7.31	1.41	5.57	1.81	6.40
4	0100	0.92	16.00	1.34	7.53	1.48	7.53	1.86	7.76
	0700	1.22	8.26	1.40	8.53	1.71	15.06	1.93	9.48
	1300	0.90	14.22	1.13	10.67	1.20	14.22	1.51	9.14
	1900	0.64	13.47	0.88	12.80	0.92	12.19	1.21	12.19
5	0100	0.70	5.02	0.89	12.19	0.95	12.19	1.25	4.92
	0700	0.87	6.40	0.89	5.95	0.99	6.40	1.27	5.95
	1300	0.79	6.09	0.85	6.24	0.92	6.92	1.12	6.24
	1900	0.55	6.24	0.60	11.64	0.63	5.69	0.77	5.57
6	0100	0.41	4.27	0.57	11.64	0.59	6.74	0.71	6.24
	0700	0.40	11.13	0.52	11.64	0.51	12.19	0.54	11.13
	1300	0.29	14.22	0.49	14.22	0.46	11.64	0.54	14.22
	1900	0.28	14.22	0.46	13.47	0.43	12.80	0.62	13.47
7	0100	0.27	14.22	0.38	13.47	0.41	13.47	0.52	13.47
	0700	0.18	13.47	0.39	12.80	0.45	12.80	0.45	12.80
	1300	0.27	12.80	0.39	12.80	0.38	12.80	0.42	13.47
	1900	0.17	12.19	0.43	12.19	0.46	12.80	0.44	12.19
8	0100	0.79	3.77	0.87	3.82	0.82	3.88	0.91	3.94
	0700	1.05	5.12	1.48	4.83	1.58	5.12	1.58	4.92
	1300	1.29	5.69	1.89	5.95	1.97	5.69	2.39	6.09
	1900	1.11	6.40	1.89	6.74	2.07	6.92	2.38	6.74
9	0100	1.32	6.24	1.87	6.92	2.00	6.74	2.21	6.92
	0700	1.18	7.11	1.94	7.31	2.18	7.31	2.49	6.09
	1300	1.28	7.53	1.71	7.53	1.78	8.00	2.18	8.00
	1900	0.92	8.83	1.29	8.53	1.43	9.48	1.51	8.53
10	0100	0.85	7.31	0.98	10.24	1.06	9.48	1.10	8.53
	0700	0.54	9.85	0.82	9.48	0.86	9.85	0.86	9.14
	1300	0.35	10.24	0.57	9.85	0.61	9.85	0.67	9.85
	1900	0.30	12.19	0.53	9.14	0.55	10.24	0.51	10.24
11	0100	1.11	4.49	1.06	4.57	0.99	4.57	1.36	4.66
	0700	1.07	6.40	1.30	6.24	1.41	6.09	1.57	5.95
	1300	1.12	7.11	1.23	7.11	1.27	7.31	1.44	6.92
	1900	0.89	6.56	0.94	7.31	0.95	6.56	1.13	7.31
12	0100	0.72	6.24	0.79	6.56	0.79	6.09	0.93	6.56
	0700	0.46	12.80	0.60	12.80	0.65	8.83	0.64	6.56
	1300	0.32	14.22	0.53	13.47	0.55	12.80	*	
	1900	0.29	12.80	0.49	12.80	0.47	12.80	0.51	12.80
13	0100	0.33	12.19	0.44	12.19	0.46	12.80	0.60	12.19
	0700	0.35	12.80	0.38	5.69	0.44	12.19	0.66	5.45
	1300	0.20	12.19	0.37	6.09	0.39	6.24	*	
	1900	0.26	12.80	0.35	6.24	0.37	12.19	0.64	6.40
14	0100	0.51	2.56	0.55	3.01	0.37	3.37	0.70	6.24
	0700	1.30	6.74	1.81	6.56	2.13	6.40	2.25	6.74
	1300	0.98	7.31	1.67	6.92	1.77	7.31	1.88	7.53
	1900	1.15	7.11	1.29	8.83	1.38	8.00	1.53	7.11
15	0100	0.98	5.33	1.30	5.45	1.26	5.69	1.42	5.22
	0700	0.92	5.33	1.00	6.09	1.09	6.56	1.18	5.95
	1300	0.72	5.33	1.09	5.95	1.06	5.95	1.26	6.24
	1900	0.87	6.92	0.99	6.40	1.14	6.56	1.31	6.56
16	0100	0.59	6.74	0.85	6.74	0.87	6.74	1.11	6.92
	0700	0.50	7.31	0.51	6.92	0.62	6.92	0.90	7.11
	1300	0.29	7.53	0.38	8.26	0.37	7.53	0.57	6.92
	1900	0.66	3.77	0.62	3.88	0.69	3.88	0.79	4.06

* Electronic problems

(Continued)

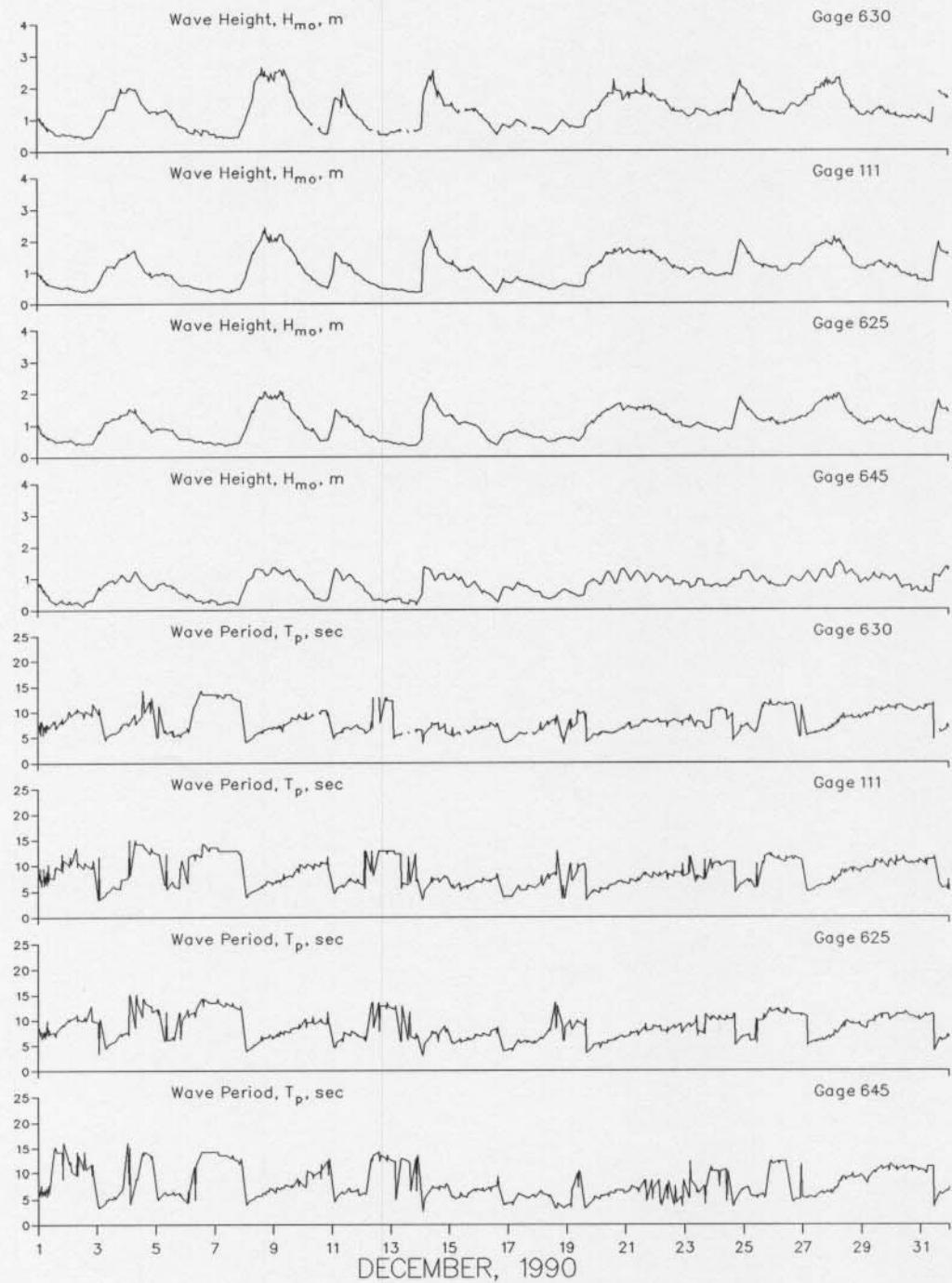
Table 3: Wave Data

Dec 1990

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo.m T.sec	Baylor at 18+60	Hmo.m T.sec	Pressure Gage	Hmo.m T.sec	Offshrd Wvrdr	Hmo.m T.sec
17	0100	0.66	4.27	0.76	4.27	0.66	3.94	0.72	4.20
	0700	0.85	6.09	0.82	6.09	0.82	5.95	0.97	5.45
	1300	0.75	5.33	0.70	5.95	0.70	5.22	0.84	5.45
	1900	0.57	5.82	0.62	5.33	0.65	5.82	0.71	5.82
18	0100	0.56	6.56	0.57	6.40	0.57	6.56	0.68	6.56
	0700	0.34	5.69	0.47	7.76	0.49	8.26	0.54	8.00
	1300	0.39	3.08	0.47	13.47	0.45	8.53	0.62	8.53
	1900	0.60	3.37	0.57	8.83	0.56	3.56	0.92	4.83
19	0100	0.55	4.06	0.55	9.85	0.55	10.24	0.78	8.26
	0700	0.45	9.85	0.51	9.85	0.53	8.83	0.72	7.53
	1300	0.45	3.24	0.64	8.83	0.53	10.24	0.73	9.85
	1900	0.93	4.57	1.06	4.57	1.12	4.92	1.22	4.92
20	0100	0.82	4.92	1.27	5.33	1.24	4.57	1.31	5.22
	0700	1.16	5.82	1.43	5.33	1.59	5.57	1.68	5.82
	1300	0.93	6.09	1.54	6.09	1.55	6.40	1.77	5.69
	1900	1.26	6.74	1.65	6.92	1.74	6.92	1.86	6.56
21	0100	1.04	6.56	1.59	6.92	1.70	6.40	1.83	7.76
	0700	1.18	6.92	1.51	7.53	1.56	6.74	1.79	7.11
	1300	1.03	8.53	1.50	8.53	1.60	8.53	1.74	8.26
	1900	1.03	8.53	1.59	8.00	1.65	7.53	1.71	7.76
22	0100	1.01	8.53	1.41	8.53	1.42	7.76	1.60	8.53
	0700	1.02	7.76	1.29	7.76	1.43	8.83	1.55	8.00
	1300	0.93	3.82	1.06	8.83	1.11	7.76	1.22	8.26
	1900	0.78	5.45	1.04	9.14	1.08	8.53	1.22	7.76
23	0100	0.83	5.22	0.91	9.14	0.96	8.26	1.07	8.53
	0700	0.75	7.31	0.97	9.48	1.07	6.74	1.16	6.92
	1300	0.92	7.53	0.96	7.31	1.09	7.11	1.24	7.76
	1900	0.75	11.13	0.88	9.85	0.88	11.13	1.08	6.74
24	0100	0.79	10.24	0.82	9.85	0.84	10.67	1.16	10.67
	0700	0.76	10.67	0.86	9.85	0.92	10.24	1.25	10.24
	1300	0.89	3.61	0.83	10.24	0.87	10.67	1.21	9.48
	1900	0.96	6.56	1.81	6.40	1.98	6.40	2.13	6.09
25	0100	1.20	7.31	1.50	6.92	1.66	7.31	1.88	7.53
	0700	0.92	5.45	1.29	6.09	1.28	5.57	1.45	5.82
	1300	1.03	5.95	1.08	9.85	1.18	10.67	1.28	11.13
	1900	0.77	12.19	1.13	12.19	1.12	12.19	1.21	11.13
26	0100	0.73	12.19	0.99	12.19	1.13	11.13	1.20	11.13
	0700	0.73	12.19	1.02	11.13	0.98	10.67	1.16	11.13
	1300	1.04	4.66	1.12	11.13	1.17	11.64	1.42	11.64
	1900	0.87	4.92	1.20	11.13	1.20	11.13	1.34	4.92
27	0100	1.15	5.02	1.21	10.67	1.38	4.92	1.60	5.22
	0700	0.93	5.33	1.42	5.69	1.61	5.33	1.72	5.57
	1300	1.19	6.40	1.71	6.09	1.81	6.09	1.94	6.09
	1900	1.04	6.24	1.72	6.92	1.89	6.56	2.03	6.74
28	0100	1.45	7.11	1.81	7.31	1.91	7.11	2.11	7.31
	0700	1.33	9.14	1.67	9.48	1.78	8.53	1.90	9.48
	1300	1.21	9.14	1.28	9.14	1.44	9.48	1.50	8.83
	1900	0.99	9.14	1.10	9.14	1.12	8.83	1.18	8.83
29	0100	0.97	8.26	0.95	8.26	1.08	9.48	1.08	9.48
	0700	1.05	10.24	1.03	9.85	1.16	9.48	1.09	9.48
	1300	0.94	11.13	1.23	11.13	1.31	10.24	1.34	10.24
	1900	0.99	11.13	1.06	11.13	1.12	9.48	1.12	10.67
30	0100	1.08	10.67	1.13	10.67	1.10	9.85	1.10	10.67
	0700	0.64	11.13	0.89	11.13	0.91	11.13	1.00	11.13
	1300	0.74	11.13	0.80	10.67	0.85	10.24	0.99	10.24
	1900	0.69	10.67	0.71	10.24	0.85	10.67	0.98	10.24
31	0100	0.52	10.24	0.85	10.67	0.69	10.24	0.96	10.24
	0700	0.53	11.13	0.67	11.13	0.69	11.13	0.84	11.13
	1300	1.03	6.24	1.75	6.24	1.92	6.24	*	
	1900	1.33	6.56	1.46	6.24	1.56	5.69	1.69	6.40
Mean		0.77	8.12	0.99	8.56	1.04	8.35	1.19	8.02
Std dev		0.32	3.22	0.43	2.56	0.48	2.68	0.51	2.35

* Electronic problems

(Sheet 2 of 2)



PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Dec 1990

Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements				Current Meter	
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline	Speed	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	Speed
Time	Speed	Dir	(m)	Dir						
Day										
1 0100-Along Cross Result									20	S
									12	off
									23	129
1 0700-Along Cross Result	12	S		36	S		3	S	22	S
	0		177	11	off	North			8	off
	12	160		37	143				23	140
1 1300-Along Cross Result									0	
									6	on
									6	250
1 1900-Along Cross Result									2	N
									3	off
									4	36
2 0100-Along Cross Result									13	N
									9	on
									16	305
2 0700-Along Cross Result	8	N		7	S		7	N	8	N
	8	off	165	12	off	North			5	on
	12	25		13	100				9	308
2 1300-Along Cross Result									9	N
									5	on
									10	311
2 1900-Along Cross Result									6	S
									0	
									6	160
3 0100-Along Cross Result									11	S
									3	off
									11	145
3 0700-Along Cross Result	12	N		9	S		3	S	2	N
	0		165	11	off	North			1	off
	12	340		14	109				2	7
3 1300-Along Cross Result									11	S
									1	on
									11	165
3 1900-Along Cross Result									2	N
									1	on
									2	313
4 0100-Along Cross Result									28	N
									9	on
									29	322
4 0700-Along Cross Result	12	N		36	N		23	N	28	N
	18	off	165	0		South			10	on
	21	36		36	340				30	320
4 1300-Along Cross Result									12	N
									10	on
									16	300
4 1900-Along Cross Result									11	S
									5	off
									12	136
5 0100-Along Cross Result									24	S
									6	off
									25	146
5 0700-Along Cross Result	51	S		44	S		71	S	4	S
	0		152	11	off	North			0	
	51	160		45	146				4	160
5 1300-Along Cross Result									15	S
									4	off
									16	145
5 1900-Along Cross Result									3	N
									4	on
									5	287

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1990

Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements			Current Meter	
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	(500m Updrift)			0.9 km Offshore Depth -5.6m (NGVD) ID #519			
Day	Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	
6 0100-Along Cross Result							4	N	
6 0700-Along Cross Result	12 9 15	S off 125	146	2 0 2	S 0 160	South	0		0
6 1300-Along Cross Result							16	N	
6 1900-Along Cross Result							6	on	
7 0100-Along Cross Result							17	319	
7 0700-Along Cross Result	10 1 10	N off 349	126	2 0 2	N 0 340	South	1	N	12
7 1300-Along Cross Result							8		3
7 1900-Along Cross Result							17	N	on
8 0100-Along Cross Result							6		12
8 0700-Along Cross Result	68 0	S 160	177	102 0 102	S 0 160	North	49	S	8
8 1300-Along Cross Result							18		326
8 1900-Along Cross Result							17	S	321
9 0100-Along Cross Result							6		321
9 0700-Along Cross Result	87 0	S 160	165	102 25 105	S on 174	North	51	S	8
9 1300-Along Cross Result							17	off	141
9 1900-Along Cross Result							45		147
10 0100-Along Cross Result							42	S	
10 0700-Along Cross Result	15 23 27	N off 36	152	51 13 52	S off 146	North	13	N	17
10 1300-Along Cross Result							51		147
10 1900-Along Cross Result							31	S	

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1990

Alongshore Cross-shore Resultant Time	Pier Measurements						Beach Measurements			Current Meter	
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)		(500m Updrift)			Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
Day	Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location		Speed	Dir	Speed	Dir
11 0100-Along Cross Result										12	N
										3	off
										12	354
11 0700-Along Cross Result	51	S	165	41	S	North	20	S		28	S
	0			0						11	off
	51	160		41	160					30	139
11 1300-Along Cross Result										20	S
										8	off
										22	138
11 1900-Along Cross Result										12	S
										5	off
										13	137
12 0100-Along Cross Result										0	
										3	on
										3	250
12 0700-Along Cross Result	7	N	142	28	S	South	37	N		0	
	3	on		10	off					1	on
	8	321		29	141					1	250
12 1300-Along Cross Result										9	N
										7	on
										11	302
12 1900-Along Cross Result										4	N
										3	on
										5	303
13 0100-Along Cross Result										15	N
										9	on
										17	309
13 0700-Along Cross Result	10	N	138	25	N	South	8	N		9	N
	12	off		13	off					7	on
	16	31		28	7					11	302
13 1300-Along Cross Result										12	N
										8	on
										14	306
13 1900-Along Cross Result										4	N
										3	on
										5	303
14 0100-Along Cross Result										7	S
										8	off
										11	111
14 0700-Along Cross Result	23	S	165	51	S	North	17	S		41	S
	11	on		51	on					13	off
	25	187		72	205					43	142
14 1300-Along Cross Result										26	S
										8	off
										27	143
14 1900-Along Cross Result										25	S
										8	off
										26	142
15 0100-Along Cross Result										13	S
										4	off
										14	143
15 0700-Along Cross Result	24	N	165	25	N	South	37	N		10	S
	0			13	off					1	off
	24	340		28	7					10	154
15 1300-Along Cross Result										1	N
										3	on
										3	268
15 1900-Along Cross Result										6	S
										3	off
										7	133

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1990

Day	Time	Pier Measurements				Beach Measurements			Current Meter			
		Alongshore Cross-shore Resultant	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir
16	0100-Along Cross Result										6	N
											4	on
											7	306
16	0700-Along Cross Result		5 12 13	N off 48	165	13 7 15	N off 7		12 N		14 5 15	N on 320
16	1300-Along Cross Result										9 3 9	N on 322
16	1900-Along Cross Result										14 5 15	S off 140
17	0100-Along Cross Result										13 3 13	S off 147
17	0700-Along Cross Result		32 8 33	S on 174	140	23 0 23	S North	36	S		7 3 8	S off 137
17	1300-Along Cross Result										6 0 6	S off 160
17	1900-Along Cross Result										4 2 4	S off 133
18	0100-Along Cross Result										5 1 5	S on 171
18	0700-Along Cross Result		30 15 34	N off 7	128	13 6 14	N off 7	25	N		10 7 12	N on 305
18	1300-Along Cross Result										8 8 11	N on 295
18	1900-Along Cross Result										21 8 22	N on 319
19	0100-Along Cross Result										14 6 15	N on 317
19	0700-Along Cross Result		14 10 17	S on 197	152	13 0 13	S North	5	N		7 2 7	N on 324
19	1300-Along Cross Result										11 5 12	S off 136
19	1900-Along Cross Result										14 4 15	S off 144
20	0100-Along Cross Result										22 8 23	S off 140
20	0700-Along Cross Result		20 10 23	S on 187	165	61 0 61	S North	41	S		17 6 18	S off 141
20	1300-Along Cross Result										22 9 24	S off 138
20	1900-Along Cross Result										22 7 23	S off 142

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1990

Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements				Current Meter	
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
Day	Speed	Dir								
21 0100-Along Cross Result										23 S
										6 off
										24 145
21 0700-Along Cross Result	22 0	S	165	55	N	76	N	25	S	
	22	160		0	340	South		14	off	
				55				29	131	
21 1300-Along Cross Result								22	S	
								5	on	
								23	173	
21 1900-Along Cross Result								16	S	
								9	off	
								18	131	
22 0100-Along Cross Result								11	S	
								7	off	
								13	128	
22 0700-Along Cross Result	27 0	N	138	47	N	79	N	6	N	
	27	340		7	on	South		4	on	
				47	331			7	306	
22 1300-Along Cross Result								3	S	
								1	on	
								3	178	
22 1900-Along Cross Result								4	N	
								1	on	
								4	326	
23 0100-Along Cross Result								4	S	
								1	on	
								4	174	
23 0700-Along Cross Result	38 0	N	144	87	N	137	N	14	N	
	38	340		0	340	South		8	on	
				87				16	310	
23 1300-Along Cross Result								13	N	
								8	on	
								15	308	
23 1900-Along Cross Result								15	N	
								7	on	
								17	315	
24 0100-Along Cross Result								15	N	
								7	on	
								17	315	
24 0700-Along Cross Result	30 11	N off	140	34	N	15	N	28	N	
	32	359		12	off	North		10	on	
				36	359			30	320	
24 1300-Along Cross Result								3	N	
								3	off	
								4	25	
24 1900-Along Cross Result								28	S	
								9	off	
								29	142	
25 0100-Along Cross Result								25	S	
								8	off	
								26	142	
25 0700-Along Cross Result	38 8	S on	152	44	S	10	S	17	S	
	39	171		7	on	North		5	off	
				44	169			18	144	
25 1300-Along Cross Result								19	S	
								5	off	
								20	145	
25 1900-Along Cross Result								14	S	
								5	off	
								15	140	

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1990

Alongshore Cross-shore Resultant ---- Time	Pier Measurements				Beach Measurements			Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Dye at Mid-Surf Zone (surface)		(500m Updrift)		Depth -5.6m (NGVD)	0.9 km Offshore ID #519	
Day	Speed	Dir	Speed	Dir	Location	Speed	Dir	Speed	Dir
26 0100-Along Cross Result								17	S
								4	off
								17	147
26 0700-Along Cross Result	55 19 59	S on 179	152	55 28 62	S off 133	43	S	34	S
								20	off
								39	130
26 1300-Along Cross Result								41	S
								17	off
								44	137
26 1900-Along Cross Result								32	S
								10	off
								34	143
27 0100-Along Cross Result								23	S
								5	off
								24	148
27 0700-Along Cross Result	44 61 75	S on 214	149	87 122 150	S on 214	23	S	37	S
								13	off
								39	141
27 1300-Along Cross Result								32	S
								13	off
								35	138
27 1900-Along Cross Result								30	S
								9	off
								31	143
28 0100-Along Cross Result								37	S
								8	off
								38	148
28 0700-Along Cross Result	41 14 43	S off 141	152	68 0 68	S 160	15	S	38	S
								16	off
								41	137
28 1300-Along Cross Result								15	S
								1	off
								15	156
28 1900-Along Cross Result								35	S
								12	off
								37	141
29 0100-Along Cross Result								19	S
								7	off
								20	140
29 0700-Along Cross Result	61 0 61	S 160	138	55 0 55	S 160	8	S	21	S
								7	off
								22	142
29 1300-Along Cross Result								27	S
								6	off
								28	147
29 1900-Along Cross Result								14	S
								4	off
								15	144
30 0100-Along Cross Result								0	
								0	
								0	
30 0700-Along Cross Result	18 18 26	N off 25	126	44 13 45	N off 357	61	N	9	N
								7	on
								11	302
30 1300-Along Cross Result								17	N
								7	on
								18	318
30 1900-Along Cross Result								5	N
								7	on
								9	286

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Concluded)
Dec 1990

Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements			Current Meter	
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	0.9 km Offshore Depth -5.6m (NGVD) ID #519	Dir
Day	Speed	Dir	Speed	Dir	Location	Speed	Dir	Speed	Dir
31 0100-Along Cross Result								14	N
								15	on
								21	293
31 0700-Along Cross Result	34 17 38	S on 187	140	76 0 76	S North	61	S	10 1 10	N on 334
31 1300-Along Cross Result								28 10 30	S off 140
31 1900-Along Cross Result								29 11 31	S off 139

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Dec 1990

Day	Time	Wave Approach			Radar Wave Angle deg from True N	Width of Surf Zone.m	Water Characteristics at Pier End		
		Primary	Secondary	deg from True N			Temp.,C	Density g/cc	Secchi Vis.,m
1	1140	50	95			133	13.0	1.0228	3.4
2	1035	105				113	13.9	1.0235	2.7
3	1000	95	50			149	13.9	1.0234	1.5
4	0910	120			100	223	1.5	1.0236	1.2
5	0855	20			40	110	13.3	1.0250	0.9
6	1430	none visible				110	12.8	1.0248	0.6
7	1015	130			inoperative	9	13.3	1.0251	2.4
8	1230	60	35		60	165	12.8	1.0246	1.2
9	1150	35			45	172	11.1	1.0222	0.6
10	0838	60				117	11.7	1.0228	0.3
11	0705	40	25		40	163	11.7	1.0240	0.3
12	0820	60				126	11.7	1.0236	1.5
13	1000	140				110	12.8	1.0240	1.2
14	0935	45	25		45	450	12.2	1.0244	0.6
15	1255	90	70			198	11.7	1.0239	1.5
16	1140	105				133	12.2	1.0242	1.2
17	0900	40	60			8	11.7	1.0240	1.5
18	0942	80				8	12.2	1.0240	1.5
19	0850	100				29	12.8	1.0242	2.1
20	0925	45		85	45	171	12.2	1.0242	0.6
21	0815	100		65	inoperative	207	12.2	1.0245	1.2
22	0830	90				152	12.8	1.0220	2.7
23	0730	90				173	12.8	1.0234	2.1
24	1230	140				164	13.9	1.0240	1.5
25	1220	80		50	85	107	13.9	1.0242	1.2
26	0845	100			75	185	10.5	1.0228	1.2
27	0920	70			70	197	9.9	1.0205	2.1
28	0730	80				205	10.0	1.0214	1.2
29	0730	80				142	10.0	1.0206	2.1
30	0650	130				158	11.1	1.0209	2.4
31	0740	30				166	12.2	1.0240	2.4

PART VI: WATER LEVELS

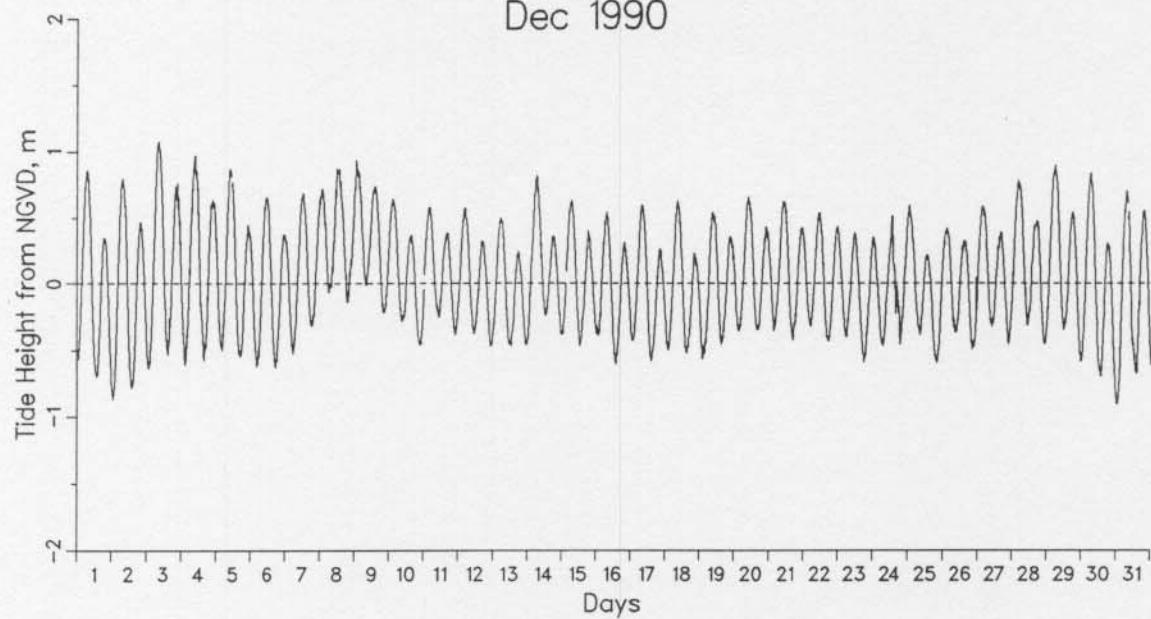
Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Dec 1990



Monthly Water Levels, m NGVD

Extreme Low = -0.91 on day 31 at 24 EST
Extreme High = 1.08 on day 3 at 736 EST
Monthly Mean = 0.05
Mean Low = -0.50
Mean High = 0.56
Mean Range = 1.06

Table 6: Water Levels.m NGVD

Day	Mid-Cycle Time	Dec 1990	Low	High	Mean	Range
1	612	-0.69	0.86	0.14	1.55	
1	1837	-0.87	0.35	-0.24	1.21	
2	703	-0.79	0.80	0.04	1.58	
2	1928	-0.77	0.47	-0.15	1.24	
3	753	-0.60	1.08	0.28	1.67	
3	2018	-0.61	0.76	0.09	1.37	
4	843	-0.57	0.97	0.24	1.54	
4	2109	-0.58	0.64	0.07	1.21	
5	934	-0.53	0.87	0.18	1.40	
5	2159	-0.62	0.45	-0.09	1.06	
6	1024	-0.62	0.66	0.06	1.28	
6	2249	-0.62	0.37	-0.07	1.00	
7	1115	-0.49	0.68	0.15	1.18	
7	2340	-0.31	0.72	0.25	1.03	
8	1205	-0.13	0.87	0.40	1.01	
9	30	-0.13	0.94	0.42	1.07	
9	1255	-0.21	0.74	0.33	0.95	
10	121	-0.24	0.65	0.21	0.89	
10	1346	-0.42	0.37	0.00	0.79	
11	211	-0.46	0.58	0.11	1.04	
11	1436	-0.35	0.38	0.04	0.74	
12	301	-0.38	0.58	0.11	0.96	
12	1527	-0.46	0.32	-0.06	0.78	
13	352	-0.47	0.50	0.04	0.97	
13	1617	-0.46	0.24	-0.15	0.70	
14	442	-0.45	0.82	0.24	1.26	
14	1707	-0.37	0.36	0.01	0.73	
15	532	-0.40	0.63	0.13	1.03	
15	1758	-0.47	0.40	-0.05	0.87	
16	623	-0.57	0.54	0.03	1.11	
16	1848	-0.60	0.31	-0.13	0.91	
17	713	-0.57	0.60	0.07	1.17	
17	1938	-0.58	0.27	-0.16	0.84	
18	804	-0.52	0.63	0.08	1.16	
18	2029	-0.56	0.23	-0.18	0.80	
19	854	-0.52	0.54	0.04	1.06	
19	2119	-0.43	0.36	-0.03	0.79	
20	944	-0.34	0.66	0.16	1.00	
20	2210	-0.35	0.43	0.03	0.78	
21	1035	-0.42	0.62	0.14	1.04	
21	2300	-0.32	0.42	0.03	0.74	
22	1125	-0.43	0.54	0.06	0.97	
22	2350	-0.40	0.43	0.01	0.83	
23	1216	-0.59	0.38	-0.07	0.97	
24	41	-0.49	0.35	-0.08	0.84	
24	1306	-0.45	0.52	-0.03	0.97	
25	131	-0.38	0.59	0.12	0.98	
25	1356	-0.59	0.22	-0.16	0.81	
26	222	-0.49	0.42	0.02	0.91	
26	1447	-0.49	0.32	-0.05	0.81	
27	312	-0.43	0.58	0.13	1.01	
27	1537	-0.46	0.39	-0.01	0.85	
28	402	-0.33	0.78	0.27	1.11	
28	1628	-0.45	0.48	0.05	0.93	
29	453	-0.39	0.89	0.30	1.28	
29	1718	-0.59	0.54	0.01	1.12	
30	543	-0.66	0.84	0.14	1.49	
30	1808	-0.90	0.31	-0.27	1.21	
31	634	-0.91	0.70	-0.03	1.61	
31	1859	-0.68	0.55	-0.02	1.23	

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

During December the CRAB was inoperable while awaiting repair parts. As a result there were no surveys performed. Figure 5 is the November survey and is included for reference.

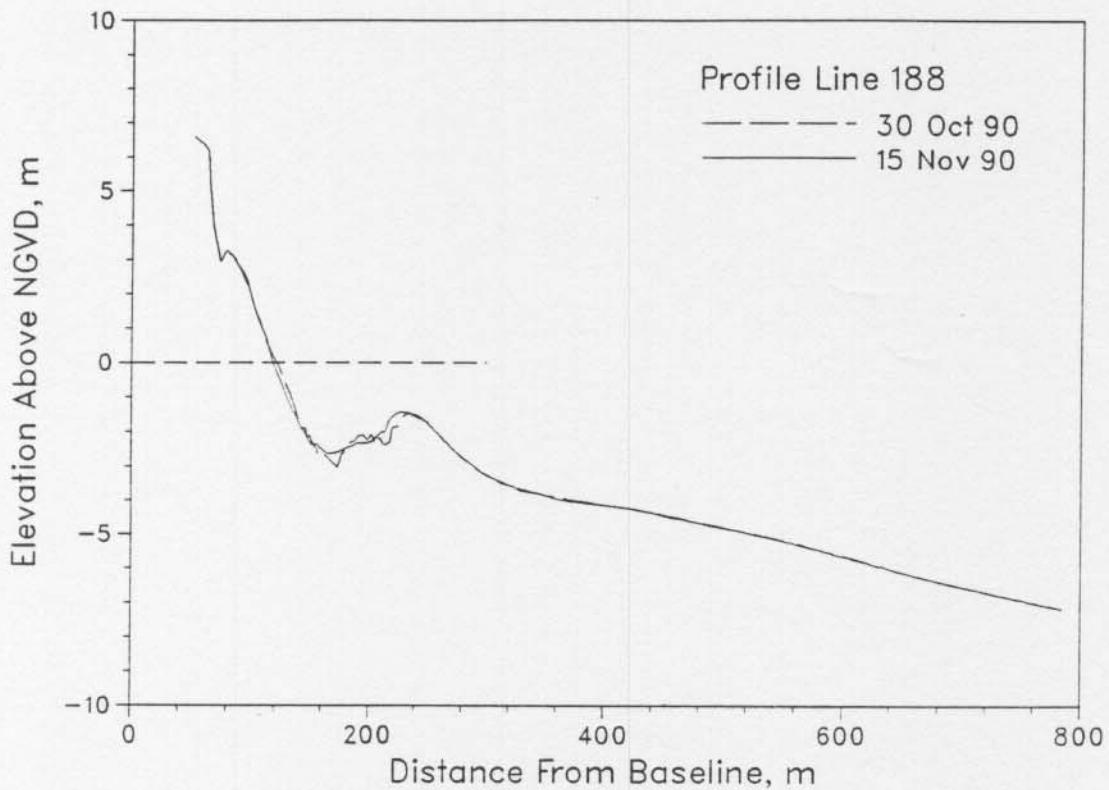


Figure 5. Monthly CRAB profiles on profile 188 -
517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1990. Due to the lack of December surveys the November envelope is included.

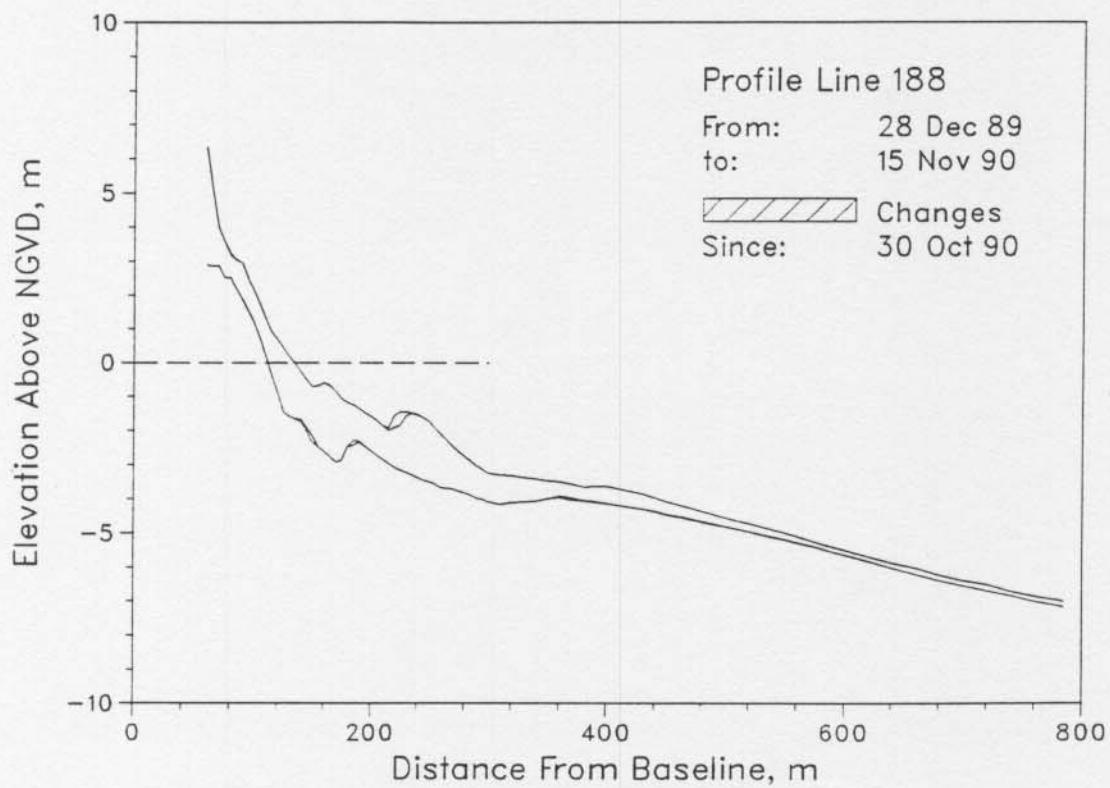


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the most recent bathymetric survey on 31 October. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

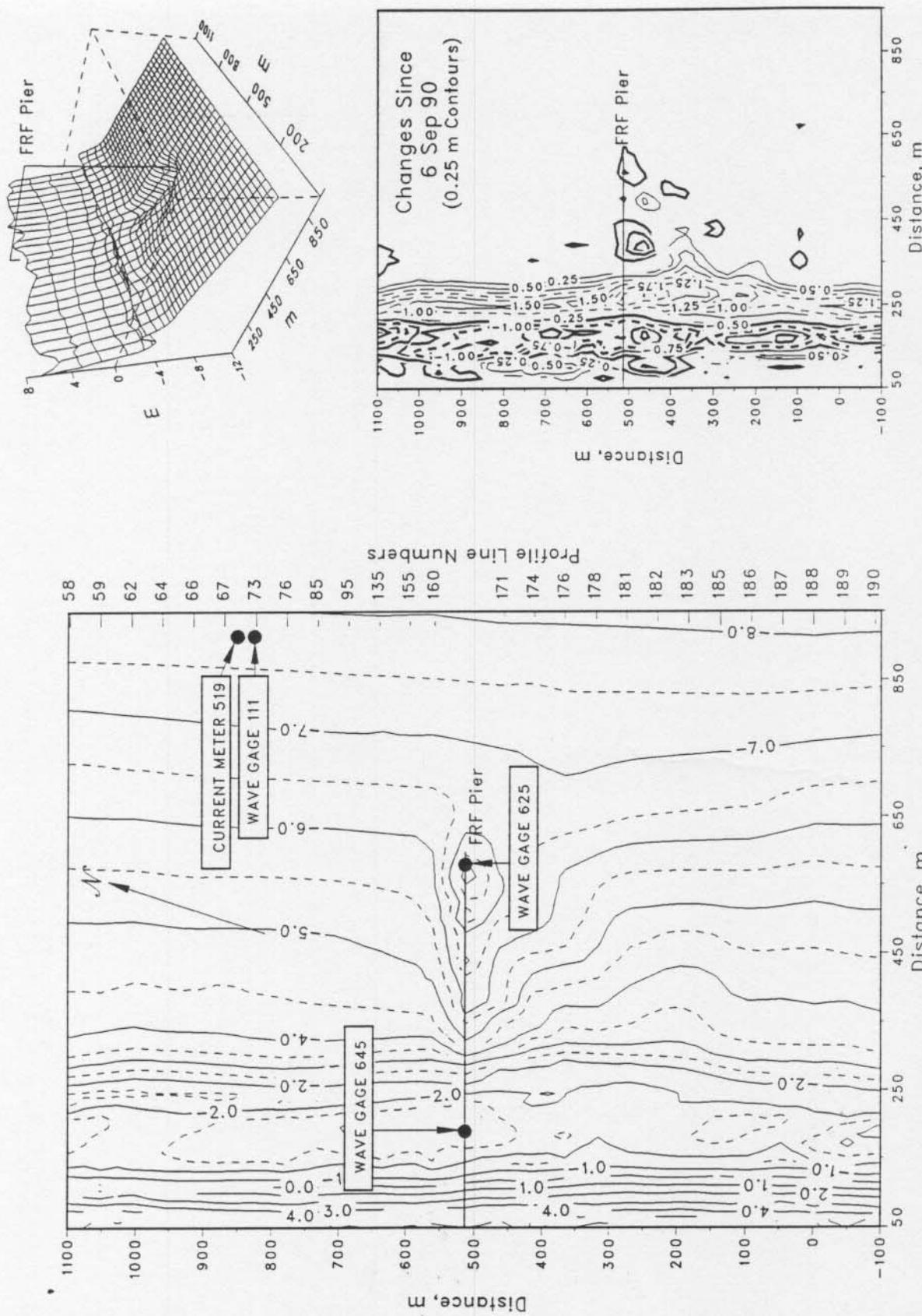


Figure 8. FRF bathymetry 31 Oct 90 depths relative to NGVD

PART VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the significant wave height at the seaward end of the pier (i.e. as measured near the end of the pier) exceeded 2 m and four contiguous 34 minute wave records were obtained every three hours:

<u>Start</u>	<u>End</u>
8 Dec (1634)	9 Dec (0734)

B. Storm Synopsis.

8-9 December - Developing over Texas on 6 December this small coastal storm rapidly moved into the Atlantic being located off Cape Hatteras, NC on 8 December. The minimum atmospheric pressure of 1010.0 mb was recorded on 8 December at 1442 EST followed (at 1600 EST) by the peak wind speed (from north-northwest) which surpassed 15 m/s. The maximum H_{mo} (at gage 625) of 2.08 m ($T_p = 9.48$ sec) occurred on 9 December at 0542 EST. Total precipitation was 24 mm.

Distribution List

Government Agencies:

OCE	U.S. Geological Survey
BERH	U.S. National Park Service
NAO	U.S. Naval Academy
NASA/Wallops Flight Center	U.S. Naval Civil Eng. Lab
NOAA (NOS, NWS)	U.S. Naval Fac. Eng. Com.
SAD	U.S. Naval Oceanographic Off.
SAW	U.S. Naval Research Lab

Colleges/Universities:

California Inst. of Tech.	Stockton State College
East Carolina University	University of Akron
Florida Inst. of Tech.	University of Delaware
Harvard University	University of Florida
Naval Post Graduate School	University of Maryland
NC State University	University of Miami
Old Dominion University	University of North Carolina
Oregon State University	University of N. Colorado
Prince George's College	University of Rhode Island
Rutgers University	University of Virginia
Scripps Inst. of Oceanography	Va. Inst. of Marine Science
Southern Illinois University	

Others:

City of Va. Beach, VA	MEC Systems Corporation
Coastal Barge Corporation	Moffatt & Nichol, Eng.
Coastal and Est. Res., Inc.	Offshore Coastal Technologies
Coastal Science & Eng., Inc.	Mr. Rowland
Dr. Galvin	Mr. Savage
GEOMET Tech., Inc.	Sea Port Supply Corp.
Greenhorne & O'Mara, Inc.	Shell Development
Dr. Hylton	Sherwood Industries
Mary Marr, Inc.	Mr. & Mrs. Valpey
Mr. Mason	WCTI-TV
Masonite Corporation	SEASUN Power Systems

Foreign:

W. F. Baird & Asso. Coastal Engineers, Ltd (Canada)
Queen's University, Ontario (Canada)
Ministry of Construction, Coastal Division (Japan)
Norwegian Hydrodynamic Laboratories (Norway)
University of New South Wales (Australia)
University of Sydney (Australia)